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ABSTRACT

There are a variety of computing tools available in educational institutions. With the knowledge of standard tools and how they can be used to compliment one another, students can gain impressive skills in information presentation. This paper describes a method for science students to use in preparing data for analysis and dissemination and informs about the interactive nature of the technology. A sample project demonstrates the following general procedure for using a word processor and spreadsheet to develop a project: (1) generate data with an application on a computer program; (2) import data into a spreadsheet; (3) organize and label data using a spreadsheet; (4) construct graphs of data using a spreadsheet; (5) write the text to communicate the results of the project using a word processor; (6) input spreadsheet data into the word processor for formal presentation; (7) utilize special features of the word processor to highlight the information and to shorten the overall preparation time; and (8) produce the hardcopy to communicate the results. An appendix provides a sample basic program. (Author/AEF)

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Integrating PC Tools for Presenting Information in Science Classes

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Abstract

There are a variety of computing tools available for students in educational institutions. With knowledge of standard tools, and how they can be used to compliment one another, one can gain some impressive skills for presenting information. This paper demonstrates a method for science students to use in preparing data for analysis and dissemination. It also informs about the integrative nature of the tools. The sample project demonstrates the use of a wordprocessor and spreadsheet.

Introduction

Computer science and information system students routinely work with computer tools in a majority of their classes and learn how to apply those tools in the process of completing a project. Other science students, however, are often barely computer literate and have not learned how to utilize common computer tools to the extent possible. In most science classes students are required to generate data, present it in a meaningful way for analysis, and communicate that knowledge to others in written form.

The general procedure, to be illustrated in this paper via a specific example, is as follows:

1. Generate data with an application computer program. Alternatively, it might be generated with a data acquisition system for a PC, or simply entered by hand..)
2. Import data into a spreadsheet.
3. Organize and label data using a spreadsheet.
4. Construct graphs of data using a spreadsheet.
5. Write the text to communicate the results of the project using a wordprocessor.
6. Import spreadsheet data into the wordprocessor for formal presentation.
7. Utilize special features of the wordprocessor to highlight the information and to shorten the overall preparation time.
8. Produce the hardcopy to communicate the results.

In a sense this an effort in synergism, meaning that we are combining elements of information processing to produce an overall solution that is more satisfactory that would gained by arriving at it using the tools independently. Diagrammatically, the process is shown in Figure 1.

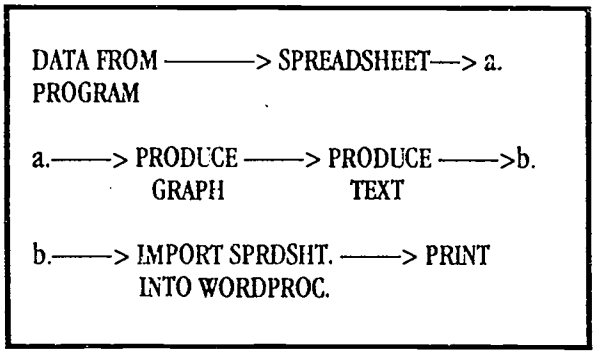

Figure 1

Although, most wordprocessors and spreadsheet programs can be used, this paper will demonstrate the method using WordPerfect 5.1 and Lotus 1-2-3, Release 2.2.

Project Description

A very good example of a project can be found in a book by D.M. Etter [1:47]. In his example, a formula for predicting the growth of bacteria is given. The formula is shown below: (note that t=elapsed time in hours, Y=colony size.)

$$Y_{new} = Y_{old} \ (e^{1.386t})$$

In other words, you could start with a certain number of bacteria in a colony and predict the number which would exist at a later time. Observe that the formula in this report was created with the equation editor in WordPerfect.

Suppose a student project requires that a report be written on the growth of bacteria. The report is to include a table of the bacteria colony sizes for every hour beginning at t=0 and culminating with t=12. It is also desired that a graph of t versus Y be included. All of this is to be submitted as a formal paper.

The student would write (or obtain) a computer program in a source language to generate the data and dump it to a file. Remember that this data could just as easily come from a data acquisition system or manual entry. A BASIC program for this example is shown in Appendix A. The output file would contain 3 columns of numbers, 12 per column, and would represent the old colony size, the time, and the new colony size. This would be analogous to accomplishing *step (1)* of the general procedure, the generation of data.

Step (2) is accomplished by moving the contents of the data file into a spreadsheet, Lotus 1-2-3. From the Lotus menu the "FILE IMPORT" function is selected, the file pathname is specified, and the numerical data is imported. *Step (3)* involves arranging and organizing the data in the spreadsheet so that it conveys information which is meaningful. Since the colony size at each hour grows exponentially, it is necessary to add another column to the spreadsheet. This column is the log of the colony size, Y(new).

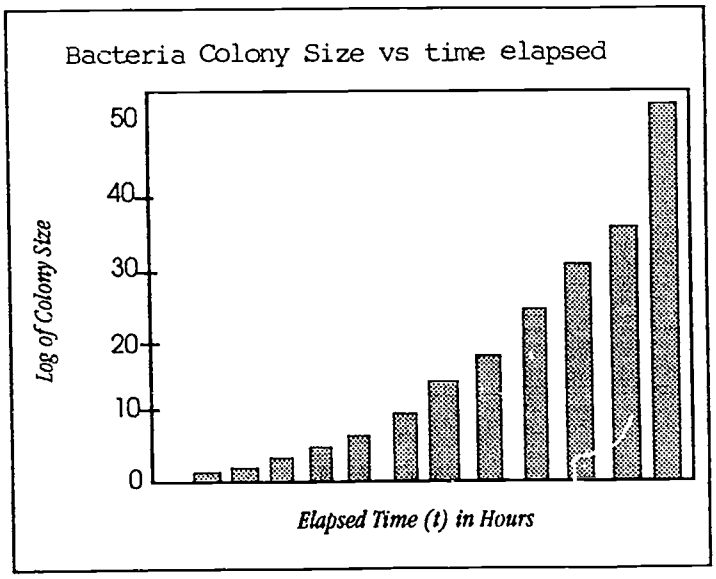

Figure 2.

When the spreadsheet is in final form, a graph of the information will be produced using the "GRAPH" function from the Lotus menu. The type of graph to be constructed will be a bar graph. That corresponds to *step (4)* in the introduction. A graph with sample data is shown in Figure 2. The graph must be saved and printed using the printgraph function of Lotus which is found in the Lotus access menu. (Note that you must have a printer capable of printing graphics to accomplish this step.)

Up to now the data that was produced from a computer program has been moved into a spreadsheet and manipulated to convey more information that would otherwise have been possible, without considerable time and difficulty. It is certainly feasible for a knowledgeable programmer to write a program to present the data in an informative manner, but it would not be realistic to expect the typical science student to be able to do this. *Step (5)* involves writing the text for the scientific report. This would be done with a wordprocessor. It is possible to do many things with your document using the advanced facilities which are available with WordPerfect 5.1. Two things that are essential in this particular example are: (1) the importing of the tabular information from the spreadsheet, and (2) creating the graph that was saved as a .pic file on disk with the Lotus spreadsheet. This corresponds to *Step 6* of our general process. When the table is imported, it will take the form of a neatly-outlined table with boxes, one for each of the cells in the spreadsheet.

To import the table you would use the "TEXT IN/OUT" function of WordPerfect. The program will present a menu with one of the options being "SPREADSHEET". Select that option, enter the name of the file, select the "IMPORT" option and you are done. The table will be positioned with its upper-left corner at the place where the text cursor is positioned. The table of the sample data is shown in Table 1.

Importing the graph is a straight-forward, trivial operation. To do this you would select the "GRAPHICS" feature from the menu, followed by "FIGURE" from the succeeding menu. Then you would use "CREATE" to set up the parameters prior to the import; the name of .pic file is the essential item at this point. Following that, the graph is moved into the document at the place where the cursor is located. There are many things that can be done with the figure after it is imported: it can be moved, resized, rotated, etc. These operations are beyond the scope of this paper, but could be accomplished to meaningfully enhance the information content.

Finally, the appearance of the scientific paper could be changed using a number of the useful features. A new word can be found to replace an overused one with the help of the online thesaurus, bold face printing can be done easily, as well as changing the font wherever a different style of printing would be more attractive. The possibilities available with the graphics and desktop publishing facilities of WordPerfect 5.1 are tremendous. One feature that all scientific writers would want to be familiar with is the equation editor which is invoked from a menu in the "GRAPHICS" function. Any mathematical symbol, of any size, can be created. Superscripting and subscripting as well as other functions are also available.

TIME (t)	COLONY SIZE	LOG
0	1.00	0.00
1	4.00e+00	0.60
2	6.39e+01	1.81
3	4.09e+03	3.61
4	1.04e+06	6.02
5	1.07e+09	9.03
6	4.36e+12	12.64
7	7.12e+16	16.85
8	4.65e+21	21.67
9	1.21e+27	27.08
10	1.27e+33	33.10
11	5.29e+39	39.72
12	8.83e+46	46.95

Table 1

Summary

The intent of this paper and the example have been to emphasize the possibilities that exist when one uses the common computer tools that are available on a campus. Most important is that they can be used in a coordinated, integrated fashion. Wordprocessing programs can be utilized with spreadsheet and database management programs. Taking the time to learn the features of application computer programs such as the ones we have used will open doors of opportunity for presenting information that heretofore might never have been considered.

Chemistry, biology, physics, math, agriculture, geology and computer science students will find nearly unlimited potential for expressing the results associated with their work. Lab reports, term papers, special projects, etc. become more than just humdrum typewritten pages when one creatively applies the tools at his disposal to them. Underpinning all of this is the concept of integration. We should be about the business of seeing things in an all-inclusive way; seeking ways of merging viable tools into our task activities. Toolboxes, today, are brimming over, but few craftsman have taken the time or effort to move beyond the obvious to the world of opportunity that awaits those who are willing to invest some time and effort in discovery.

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Appendix A: Sample Basic Program

```
10 'THIS IS A PROGRAM TO PREDICT THE GROWTH
20 'OF BACTERIA
30 '
40 'INITIAL POPULATION = 1
50 '
60 POPUL = 1
70 'INITIAL TIME = 1
80 TIME = 0
90 'NAME A DATA FILE (COMPLETE PATHNAME)
100 INPUT "DATA FILE NAME: "; DF$
110 'CALCULATE THE BACTERIAL GROWTH
120 '
130 'OPEN THE DATA FILE PRIOR TO CALCULATION
140 OPEN DF$ FOR OUTPUT AS #1
150 FOR I = 1 TO 12
160         LET POPNEW=POPUL*(2.718^(1.386*ELTIME))
170         PRINT
180         PRINT "INITIAL POPULATION ="; POPUL
190         PRINT "TIME ELAPSED="; ELTIME
200         PRINT "PREDICTED POPULATION="; POPNEW
210         POPUL = POPNEW
220         ELTIME = ELTIME + 1
230         'DUMP THE DATA TO THE FILE
240         PRINT #1, POPUL; ELTIME; POPNEW
250 NEXT I
260 END
```